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(54) TOUCH SWITCH WHICH HAS OPERATION FACE

(57)Abstract:
PROBLEM TO BE SOLVED: To give tactile feeling for response to a user positively,

concerning a touch switch which ahs an operation face 2.
SOLUTION: Movement of a transducer 7, which is processed based on the touch of the operation face 2, is given on the operation face 2.

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CLAIMS

[Claim(s)]
[Claim 1] The touch switch characterized by preparing the transducer (7) which impresses movement in the actuation side (2) in the touch switch which has an actuation side if an actuation side (2) is touched.
[Claim 2] The touch switch according to claim 1 characterized by assigning each one of transducers (7) to each touch region (1) when an actuation side (2) has two or more touch regions (1).
[Claim 3] The touch switch given in claim 1 term characterized by the transducer (7) being common in the touch region (1) when an actuation side (2) has two or more

touch regions (1).

[Claim 4] The touch switch of claims 1-3 given in any 1 term characterized by an actuation side (2) being a glass side, a glass ceramic side, or a synthetic-resin side.

[Claim 5] The touch switch of claims 1-4 given in any 1 term characterized by a transducer (7) being a piezo-electric ceramic component.

[Claim 6] a transducer (7) -- electromagnetism -- the touch switch of claims 1-4 given in any 1 term characterized by being a transducer.

[Claim 7] The touch switch of claims 1-6 given in any 1 term characterized by combining the transducer (7) with the actuation side (2) so that movement of a transducer may be transmitted to an actuation side (2).

[Claim 8] The touch switch of claims 1-6 given in any 1 term characterized by arranging the transducer (7) near the actuation side (2) so that it may knock at an actuation side (2).

[Claim 9] The touch switch of claims 1-5 given in any 1 term characterized by for a transducer being the piezo-electric ceramic component (7) which is also the sensor which detects the touch of an actuation side (2) or a touch region (1), and for a piezo-electric ceramic component (7) working as a sensor first during a touch, and then working as a transducer.

[Claim 10] The touch switch of claims 1-9 given in any 1 term characterized by designing the touch region possible [distinction] from the difference between the frequency of movement of a transducer (7), and/or the tactile sense of strength if the touch region (1) where actuation sides (2) differ is touched.

[Claim 11] The touch switch of claims 1-10 given in any 1 term characterized by the persistence time, frequency, and/or strength of movement being dependent on the touch persistence time of an actuation side (2) or a touch region (1). [a transducer (7)]

[Claim 12] The touch switch of claims 1-11 given in any 1 term characterized by combining the piezo-electric ceramic component (7) with the actuation side (2) or the touch region (1) through a connector (6).

[Claim 13] The touch switch of claims 1-12 given in any 1 term which a piezo-electric ceramic component (7) bends, and is vibrator and is characterized by arranging energization mass (10) at this bending vibrator.

[Claim 14] The touch switch of claims 1-13 given in any 1 term which a piezo-electric ceramic component (7) supports with a support plate (13) through at least one pars intermedia material (12), and is characterized by combining this support plate with the actuation side (2) through that joint element (14).

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the touch switch which has an actuation side.

[0002]

[Description of the Prior Art] Such a touch switch is well-known by EP 0054306A1, DE4207772C2, and US5594222. When an operator moves a part of switch, it is not such a touch switch, and when an operator's finger or hand changes the capacity, the line of force, or the light reflex of a touch switch, it causes a switching function.

[0003] The transparence touch switch which was based on the optical principle, capacity principle, or resistance principle for carrying out a data input on a screen is also well-known.

[0004] The touch switch using the piezo-electric effect is stated to DE 19712137A1.

[0005] Since a key is not mechanically moved in such a touch switch, the operator lacks the tactile-sense response of switch actuation. In order to still give an operator a response in addition, an acoustic signal or a lightwave signal is instead generated as a response. However, many operators give priority to a direct tactile-sense response over an acoustic signal or a lightwave signal. The to a tactile-sense stimulus rather than [people] thing late reacted to a luminous stimulus or a sound stimulus is also known.

[0006]

[Problem(s) to be Solved by the Invention] The technical problem of this invention is proposing the touch switch of the class pointed out to the beginning which gives a tactile-sense response at the time of actuation.

[0007]

[Means for Solving the Problem] According to this invention, the above-mentioned technical problem is solved by preparing the transducer which impresses movement in the actuation side, if an actuation side is touched.

[0008] Thereby, an operator's touch of an actuation side attains that a transducer impresses movement to an actuation side at real coincidence. That is, an operator receives a tactile-sense response in an actuation process. This movement can be considered as a short pulse or vibration.

[0009] In a tactile-sense response, it is also advantageous that a tactile-sense response is perceived by only the operator and noticed for some surrounding persons unlike a sound response or an optical response. In this way, the confidentiality of actuation is improving and this is what should be observed in the case of a cash dispenser.

[0010] Such a tactile-sense response can be used in the touch disk (touch screen) of computers, such as the crystallized glass cooking panel by which all the devices

operated by the touch switch, for example, a touch switch, are made into a crystallized glass cooking plate and one, a range, baking oven, a control panel for microwave ovens, a personal computer, laptop, and a personal digital assistant. A tactile-sense response can be used also in the control unit for a cash dispenser, an automatic vending machine, remote control, the input terminal of a cellular phone, a computer game, a camera, and business machines.

[0011] In one configuration of this invention, when an actuation side has two or more touch regions, each transducer is assigned to each touch region. However, it is enough, even if it prepares a single transducer when an actuation side has two or more touch regions as it became clear in the experiment. All touch regions are enough for this single transducer to enable the consciousness of a response. The range of the transducer to each touch region increases with the rise of the elastic modulus of the charge of an actuation facing. The relation regarding the place between a transducer and each touch region is not so decisive on a function, and its time relation between touches and tactile-sense signals of an actuation side or each of its touch region is decisive on a function. The tactile-sense signal should appear in the time amount by which the operator has put the finger on the touch region. Moreover, a transducer may be arranged on the outside of the field in which the indicating equipment is prepared depending on the touch region and the case.

[0012] An actuation side is a continuous glass side, a crystallized glass side, or a synthetic-resin side preferably. An actuation side can be made into the field of a comparatively big field with other functions, for example, display function, and/or cooking functions.

[0013] a transducer -- desirable -- a piezo-electric ceramic component or electromagnetism -- it is a transducer.

[0014] A transducer is combinable with an actuation side so that movement of a transducer may be transmitted to an actuation side. However, a transducer can also be attached near the actuation side so that it may knock at an actuation side. In the case of a magnetic drive transducer, especially the latter can be done so. that time -- electromagnetism -- a fixed distance is between the moving part of a transducer, and an actuation side.

[0015] In one configuration of this invention, a transducer is a piezo-electric ceramic component which is also the sensor which detects the touch of an actuation side or a touch region, and during a touch, a piezo-electric ceramic component works as a sensor first, and then works as a transducer. In this way, the same piezo-electric ceramic component takes over the switching function and movement impression function of a touch switch to coincidence.

[0016] In other one configuration, a touch of the touch region where actuation sides differ designs the (amplitude) possible [distinction] with the tactile sense in the vibration frequency and/or the strength of movement. [a transducer] Thereby, an

operator can check that inputting [which he wishes by movement of a touch region] has been performed correctly, without checking by looking. In this way, a transducer gives not only the information about a touch region touch but the check of input grasp to an operator.

[0017] In other one configuration, it depends for the (amplitude) on the touch persistence time of an actuation side or a touch region in the persistence time, frequency, and/or strength of movement. [a transducer] This is advantageous when giving various semantic **** in relation to the touch persistence time. For example, in some touch switches, if a touch becomes long, an input value will be raised or lowered. Movement which can be recognized tactually is in agreement with the input with this configuration. For example, in the case of a camera, the consciousness of functional progress "a setup of an automatic focus" and "a release" can be enabled with the tactile sense at an operator.

[0018] Many other advantageous configurations become clear from a subordination claim and the following explanation.

[0019]

[Embodiment of the Invention] Drawing 1 and drawing 2 have shown only the touch switch which has one touch region 1 in the actuation side 2 for illustration simplification. The actuation side 2 has in fact the touch region of a large number distributed by the method of of the row and column or others for inputting data with a figure or an alphabetic character. In that case, two or more touch switches are suitably prepared in the same actuation side.

[0020] The actuation side 2 is an actuation side of other devices which can set up a function through the crystallized glass plate field of for example, a range for cooking, the actuation screen (touch screen) of a computer, or a key input.

[0021] In the example of drawing 1 , a touch switch has the external electrode 4 which encloses an internal electrode 3 and this as a capacity sensor in the touch region 1 of the lower part of the actuation side 2. Such a sensor is stated to US5594222. If an operator's finger F touches the touch region 1, an electronic instrument 5 will turn on and off the cooking panel to wish to have and which is [which is and device-functions] attached.

[0022] The connector 6 arranged at the internal electrode 3 combines an internal electrode 3, therefore the touch region 1 with the piezo-electric ceramic component 7. A connector 6 is only in the central field of a piezoelectric device 7. When the piezo-electric ceramic component 7 is excited, it is the transducer of the mode of a bending (bending) trembler which gives movement in which consciousness is possible with the tactile sense according the actuation side 2 to Finger F through a connector 6.

[0023] The piezo-electric ceramic component 7 receives a signal from an electronic instrument 5 through a track 9, or exercises through the excitation circuit 8. An

electronic instrument 5 generates this signal, as long as it receives a touch signal from a sensor (electrodes 3 and 4) or especially the finger F is still put on the touch region 1. Thereby, Finger F carries out the tactile sense of the movement of the touch region 1.

[0024] If the piezo-electric ceramic component 7 is excited through the excitation circuit 8, it will give each impact or pulse pack of a mode of dynamic vibration to the touch region 1.

[0025] In order to strengthen the effectiveness of a tactile-sense response, the energization mass 10 is attached in the piezo-electric ceramic component 7 in the actuation side 2 at the opposite side. This vibration system can adjust that resonance frequency, in order to strengthen the tactile-sense response effectiveness.

[0026] Even when the actuation side 2 has two or more touch regions 1 and the original touch sensor with which it is attached, respectively, i.e., the external electrode 4 and an internal electrode 3, and respectively original electronic evaluation equipment 5, it is not necessary to necessarily arrange the transducer 7 original with each touch region 1, i.e., a piezo-electric ceramic component. In order to give a tactile-sense response, it is enough, if the single piezo-electric ceramic component 7 is separated from the touch region 1, and is arranged, and a piezo-electric ceramic component is excited and is made to exercise through the excitation circuit 8 with two or more electronic instruments 5.

[0027] An electric machine type, i.e., a magnetic drive type transducer, can be prepared instead of the piezo-electric ceramic component 7. Such a transducer has a part for the moving part of the coil which flows at the time of actuation of the excitation circuit 8, and a well-known buzzer and a loudspeaker. It is combined with the actuation side 2 or each touch region 1 by rigidity, or is made for the amount of moving part to have knock at the actuation side 2 or the touch region 1. In the case of the latter, the amount of moving part can give a slight distance from the internal electrode 3 of the actuation side 2 or the touch region 1.

[0028] In the example of drawing 2 , the piezo-electric ceramic component 7 is formed by the well-known method in itself as a sensor for a touch of the touch region 1 or the actuation side 2. The piezo-electric ceramic component 7 is connected to the electrical circuit 11, and this electrical circuit takes over the function of the electronic circuitry 5 of the example of drawing 1 , and the excitation circuit 8. In this way, sensor ability and transducer ability lengthen by the same member 7, i.e., a piezo-electric ceramic component, and a member separate for a carrier eclipse, sensor ability, and transducer ability is not needed.

[0029] If an operator touches the touch region 1 in the example of drawing 2 , while an electrical circuit 11 achieves the ****ing switching function, and having still touched the touch region 1, an electrical circuit will excite the piezo-electric ceramic component 7 with the tactile sense to movement in which consciousness is possible.

That is shown in the time amount diagram of drawing 3 by Lines a, b, and c.

[0030] An operator touches the touch region 1 at the time of t0, and a touch is ended at the time of tx (refer to line [of drawing 3] a).

[0031] When it is not already operated in advance in the circuit 11 by the time delay which can be disregarded to the time of t0, or this, it operates the sensor ability of the piezo-electric ceramic component 7 to it. A circuit 11 turns OFF sensor ability after sufficient time amount to perform the switching function to wish. This corresponds at the time (refer to line [of drawing 3] b) of t1.

[0032] After 11 turns OFF sensor ability at the time of a circuitt1, it has fixed delay and operates the transducer ability of the piezo-electric ceramic component 7 at the time of t2, and thereby, an operator receives a tactile-sense response about a switching process (refer to line [of drawing 3] c). Transducer ability is turned OFF by the circuit 11 at the time of t3 which can be made into before [at the time of tx], or the back. The persistence time of t2-t3 is limited, and the piezo-electric ceramic component 7 becomes again available as a sensor, when touching the touch region 1 at a degree.

[0033] With one configuration of this invention, a touch of a different touch region can generate a signal distinguishable in respect of a tactually distinguishable signal, for example, vibration frequency, and/or strength. In the figure block of the usual personal computer keyboard, the key of a figure "5" is equipped with the mark in which **** is possible so that it can recognize without checking by looking. Like it, with this equipment, if one key of a figure block, "5", is operated, when one of the keys of other of a figure block is operated, another tactile-sense signal can arise. [for example,]

[0034] A respectively different tactile-sense signal can be generated at the time of actuation of the function key of a keyboard, an alphabetic character key, and/or a numerical keypad.

[0035] With other configurations of this invention, the persistence time, frequency, and/or strength of movement can be dependent on the touch persistence time of the actuation side 2 or the touch region 1. [a transducer 7] The actuation function from which digital display or a bar graph (thermometer display) came to change during one actuation of a key depending on the actuation persistence time is well-known by the advanced technology. The response which ****s in the above-mentioned equipment can be attained when tactile-sense signal intensity or vibration frequency changes according to the persistence time of a key stroke. In this way, a user receives a tactile-sense response about the actual value set up each time.

[0036] In the example of drawing 2 , the piezo-electric ceramic component 7 supports with the support plate 13 through one annular pars intermedia material 12 or each pars intermedia material. A support plate 13 can respond to two or more touch regions. That is, two or more pars intermedia material 12 of two or more touch regions 1 is supportable with the same support plate 13. The support plate 13 is combined with

the actuation side 2 on the outside of a touch region through the especially annular joint element 14 or two or more one individual joint element. A support plate 13 is useful to transfer of the force stronger than arrangement of drawing 1 , or useful to oscillating transfer strengthening to the touch region 1 from a transducer 7. With the operation gestalt of drawing 1 , by transmitting the force through a connector 6 from a transducer, especially the bending trembler 7, the touch region 1 exercises and the bending trembler 7 is supported with the inertial mass of the annular momentum mass 10 outside. This is enough when the most, and it enables arrangement which the contiguity touch region approached very much compared with drawing 2 .

[0037] It is bent by the operation gestalt of drawing 2 , and vibrator 7 supports through the pars intermedia material 12 with the support plate 13 as one example which cannot be bent with it. This support plate is firmly combined with the actuation side 2 with the - joint element 14 in itself on the outside of - touch region 1. The joint element 14 cannot deform as one example. In this arrangement, the variation rate or bending which becomes effective at the time of the touch of the touch region 1 is increasing compared with the operation gestalt of drawing 1 , and it becomes easy to generate a tactile-sense signal by that.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the schematic drawing of a touch switch.

[Drawing 2] It is the schematic drawing of other touch switches.

[Drawing 3] It is a time amount diagram about the touch switch of drawing 2 .